

CLAIMS

1. Cable comprising at least one electrical conductor and at least one extruded covering layer based on a thermoplastic polymer material in admixture with a dielectric liquid, wherein:
- 5       - said thermoplastic polymer material is selected from:
- 10       (a) at least one propylene homopolymer or at least one copolymer of propylene with at least one olefin comonomer selected from ethylene and an  $\alpha$ -olefin other than propylene, said homopolymer or copolymer having a melting point greater than or equal to 130°C and a melting enthalpy of
- 15       from 20 J/g to 100 J/g;
- 20       (b) a mechanical mixture comprising at least one propylene homopolymer or copolymer (a) and (c) at least one elastomeric copolymer of ethylene with at least one aliphatic  $\alpha$ -olefin, and optionally a polyene;
- 25       - the concentration by weight of said dielectric liquid in said thermoplastic polymer material is lower than the saturation concentration of said dielectric liquid in said thermoplastic polymer material;
- 30       - said dielectric liquid has the following characteristics:
- 35       - an amount of polar compounds lower than or equal to 2.5% by weight with respect to the total weight of the dielectric liquid;
- a melting point or a pour point lower than 80°C;

- a ratio of number of aromatic carbon atoms with respect to the total number of carbon atoms lower than 0.6, when the dielectric liquid is aromatic.
- 5     2. Cable according to claim 1, wherein the propylene homopolymer or copolymer (a) has a melting point of from 140°C to 170°C.
- 10    3. Cable according to claim 1 or 2, wherein the propylene homopolymer or copolymer (a) has a melting enthalpy of from 30 J/g to 85 J/g.
- 15    4. Cable according to any one of the preceding claims, wherein the propylene homopolymer or copolymer (a) has a flexural modulus, measured according to ASTM standard D790, at room temperature, of from 30 MPa to 1400 MPa.
- 20    5. Cable according to claim 4, wherein the propylene homopolymer or copolymer (a) has a flexural modulus, measured according to ASTM standard D790, at room temperature, of from 60 MPa to 1000 MPa.
- 25    6. Cable according to any one of the preceding claims, wherein the propylene homopolymer or copolymer (a) has a melt flow index (MFI), measured at 230°C with a load of 21.6 N according to ASTM standard D1238/L, of from 0.05 dg/min to 10.0 dg/min.
- 30    7. Cable according to claim 6, wherein the propylene homopolymer or copolymer (a) has a melt flow index (MFI), measured at 230°C with a load of 21.6 N according to ASTM standard D1238/L, of from 0.4 dg/min to 5.0 dg/min.
- 35    8. Cable according to any one of the preceding claims, wherein in the propylene copolymer (a) the olefin comonomer is present in a quantity of less than or equal to 15 mol%.
9. Cable according to claim 8, wherein in the

propylene copolymer (a) the olefin comonomer is present in a quantity of less than or equal to 10 mol%.

10. Cable according to any one of the preceding  
5 claims, wherein in the propylene copolymer (a) the olefin comonomer is ethylene or an  $\alpha$ -olefin of formula  $\text{CH}_2=\text{CH}-\text{R}$ , where R is a linear or branched  $\text{C}_2\text{-C}_{10}$  alkyl.
11. Cable according to claim 10, wherein the  $\alpha$ -  
10 olefin is selected from: 1-butene, 1-pentene, 4-methyl-1-pentene, 1-hexene, 1-octene, 1-decene, 1-dodecene, or mixtures thereof.
12. Cable according to any one of the preceding  
15 claims, wherein the propylene homopolymer or copolymer (a) is selected from:
- (a<sub>1</sub>) a propylene homopolymer or a copolymer of  
propylene with at least one olefin  
comonomer selected from ethylene and an  $\alpha$ -  
olefin other than propylene, having a  
20 flexural modulus generally of from 30 MPa to 900 MPa;
- (a<sub>2</sub>) a heterophase copolymer comprising a  
thermoplastic phase based on propylene and  
an elastomeric phase based on ethylene  
25 copolymerized with an  $\alpha$ -olefin.
13. Cable according to claim 12, wherein the  
propylene homopolymer or copolymer of class (a<sub>1</sub>)  
has a melting point of from 140°C to 170°C.
14. Cable according to claim 12 or 13, wherein the  
30 propylene homopolymer or copolymer of class (a<sub>1</sub>)  
has a melting enthalpy of from 30 J/g to 80 J/g.
15. Cable according to any one of claims 12 to 14,  
wherein the propylene homopolymer or copolymer  
of class (a<sub>1</sub>) has a fraction soluble in boiling  
35 diethyl ether in an amount of less than or equal  
to 12 wt%, having a melting enthalpy of less

than or equal to 4 J/g.

16. Cable according to any one of claims 12 to 15,  
wherein the propylene homopolymer or copolymer  
of class (a<sub>1</sub>) has a fraction soluble in boiling  
n-heptane in an amount of from 15 wt% to 60 wt%,  
having a melting enthalpy of from 10 J/g to 40  
J/g.
17. Cable according to any one of claims 12 to 16,  
wherein the propylene homopolymer or copolymer  
of class (a<sub>1</sub>) has a fraction insoluble in boiling  
n-heptane in an amount of from 40 wt% to 85 wt%,  
having a melting enthalpy of greater than or  
equal to 45 J/g.
18. Cable according to claim 12, wherein the  $\alpha$ -  
olefin included in the elastomeric phase of a  
heterophase copolymer of class (a<sub>2</sub>) is propylene.
19. Cable according to claim 12, wherein the  
heterophase copolymer of class (a<sub>2</sub>) is a  
heterophase copolymer in which the elastomeric  
phase consists of an elastomeric copolymer of  
ethylene and propylene comprising from 15 wt% to  
50 wt% of ethylene and from 50 wt% to 85 wt% of  
propylene with respect to the weight of the  
elastomeric phase.
20. Cable according to any one of the preceding  
claims, wherein the elastomeric copolymer of  
ethylene (c) has a melting enthalpy of less than  
30 J/g.
21. Cable according to any one of the preceding  
claims, wherein the quantity of the elastomeric  
copolymer (c) is less than 70% with respect to  
the total weight of the thermoplastic base  
material.
22. Cable according to any one of the preceding  
claims, wherein in the elastomeric copolymer of  
ethylene (c), the term "aliphatic  $\alpha$ -olefin" is

an olefin of formula  $\text{CH}_2=\text{CH}-\text{R}$ , in which R represents a linear or branched alkyl group containing from 1 to 12 carbon atoms.

23. Cable according to claim 22, wherein the  
5 aliphatic  $\alpha$ -olefin is selected from propylene, 1-butene, isobutylene, 1-pentene, 4-methyl-1-pentene, 1-hexene, 1-octene, 1-dodecene, or mixtures thereof.
24. Cable according to claim 23, wherein the  
10 aliphatic  $\alpha$ -olefin is selected from propylene, 1-hexene, 1-octene.
25. Cable according to any one of the preceding claims, wherein in the elastomeric copolymer of ethylene (c), the term "polyene" is a conjugated  
15 or non-conjugated diene, triene or tetraene.
26. Cable according to claim 25, wherein the polyene is a diene.
27. Cable according to any one of the preceding claims, wherein the elastomeric copolymer of  
20 ethylene (c) is selected from:  
(c<sub>1</sub>) copolymers having the following monomer composition: 35 mol%-90 mol% of ethylene; 10 mol%-65 mol% of an aliphatic  $\alpha$ -olefin; 0 mol%-10 mol% of a polyene.
- 25 (c<sub>2</sub>) copolymers having the following monomer composition: 75 mol%-97 mol% of ethylene; 3 mol%-25 mol% of an aliphatic  $\alpha$ -olefin; 0 mol%-5 mol% of a polyene.
28. Cable according to any one of the preceding  
30 claims, wherein the dielectric liquid has an amount of polar compounds of between 0.1 and 2.3.
29. Cable according to any one of the preceding  
35 claims, wherein the dielectric liquid has a melting point or a pour point of between -130°C and +80°C.

30. Cable according to any one of the preceding claims, wherein the dielectric liquid has a ratio of number of aromatic carbon atoms with respect to the total number of carbon atoms of between 0.01 and 0.4.
31. Cable according to any one of the preceding claims, wherein the dielectric liquid has a dielectric constant, at 25°C, of less than or equal to 3.5 (measured in accordance with IEC 247).
32. Cable according to any one of the preceding claims, wherein the dielectric liquid has a viscosity, at 40°C, of between 10 cSt and 800 cSt (measured according to ASTM standard D445-03).
33. Cable according to claim 32, wherein the dielectric liquid has a viscosity, at 40°C, of between 20 cSt and 500 cSt (measured according to ASTM standard D445-03).
34. Cable according to any one of the preceding claims, wherein the dielectric liquid is selected from: mineral oils such as naphthenic oils, aromatic oils, paraffinic oils, polyaromatic oils, said mineral oils optionally containing at least one heteroatom selected from oxygen, nitrogen or sulphur; liquid paraffins; vegetable oils such as soybean oil, linseed oil, castor oil; oligomeric aromatic polyolefins; paraffinic waxes such as polyethylene waxes, polypropylene waxes; synthetic oils such as silicone oils, alkyl benzenes such as dodecylbenzene, di(octylbenzyl)toluene, aliphatic esters such as tetraesters of pentaerythritol, esters of sebacic acid, phthalic acid esters, olefin oligomers such as optionally hydrogenated polybutenes or

polyisobutenes; or mixtures thereof.

35. Cable according to claim 34, wherein the dielectric liquid is selected from paraffinic oils, naphthenic oils.
- 5 36. Cable according to any one of the preceding claims, wherein the weight ratio of dielectric liquid to thermoplastic polymer material is between 1:99 and 25:75.
- 10 37. Cable according to claim 36, wherein the weight ratio of dielectric liquid to thermoplastic polymer material is between 2:98 and 20:80.
38. Cable according to claim 37, wherein the weight ratio of dielectric liquid to thermoplastic polymer material is between 3:97 and 10:90.
- 15 39. Cable according to any one of the preceding claims, wherein the thermoplastic polymer material is selected from propylene homopolymers or copolymers comprising at least 40 wt% of amorphous phase, with respect to the total polymer weight.
- 20 40. Cable according to any one of the preceding claims, wherein the extruded covering layer based on said thermoplastic polymer material in admixture with said dielectric liquid is an electrically insulating layer.
- 25 41. Cable according to any one of the preceding claims, wherein the extruded covering layer based on said thermoplastic polymer material in admixture with said dielectric liquid is a semiconductive layer.
- 30 42. Polymer composition comprising a thermoplastic polymer material in admixture with a dielectric liquid, wherein:
- said thermoplastic polymer material is
- 35 selected from:

- 5 (a) at least one propylene homopolymer or at least one copolymer of propylene with at least one olefin comonomer selected from ethylene and an  $\alpha$ -olefin other than propylene, said homopolymer or copolymer having a melting point greater than or equal to 130°C and a melting enthalpy of from 20 J/g to 100 J/g;
- 10 (b) a mechanical mixture comprising at least one propylene homopolymer or copolymer (a) and (c) at least one elastomeric copolymer of ethylene with at least one aliphatic  $\alpha$ -olefin, and optionally a polyene;
- 15 - the concentration by weight of said dielectric liquid in said thermoplastic polymer material is lower than the saturation concentration of said dielectric liquid in said thermoplastic polymer material;
- 20 - said dielectric liquid has the following characteristics:
- 25 - an amount of polar compounds lower than or equal to 2.5% by weight with respect to the total weight of the dielectric liquid;
- 30 - a melting point or a pour point lower than 80°C;
- a ratio of number of aromatic carbon atoms with respect to the total number of carbon atoms lower than 0.6, when the dielectric liquid is aromatic.
43. Polymer composition according to claim 42, wherein the thermoplastic polymer material is defined according to any one of claims 2 to 27.
- 35 44. Polymer composition according to claim 42 or 43,



wherein the dielectric liquid is defined according to any one of claims 28 to 38.

45. Use of the polymer composition defined according to any one of claim 42 to 44, as the polymer  
5 base material for preparing a cable covering layer with electrical insulation properties.

46. Use of the polymer composition defined according to any one of claim 42 to 44, as the  
10 polymer base material for preparing a cable covering layer with semiconductive properties.

15

20

25

30

35